

QBio105: Methods of Science

Module Responsible:

Prof Dr. Ilka Axmann

Version:

02/01/2021

Module Organizer:

Prof Dr. Ilka Axmann

Type:

Compulsory

Lecturer:

Prof Dr Martin Lercher, Prof Dr. Ilka Axmann

Total Working Time

90 h

Credit Points

3 CP

Contact Time

30 h

Self Study

60 h

Duration

1 Semester

Course Components

Exercise:

2 SWS

Group Size

P: 20

Frequency

Every Winter Semester

Learning Competencies:

This module introduces fundamental methodologies used in science, both on a practical and on an abstract level. Students are acquainted with the process of scientific publication and the central role of citations in scientific communication, and they learn how to identify and read relevant scientific literature. They learn how to structure and write scientific papers and lab protocols, what makes scientific graphics effective, and how to effectively summarize a project or procedure.

Furthermore, students are made aware of the central role of hypothesis testing and falsification in science and understand the difference between scientific and non-scientific forms of knowledge generation. After the course, they appreciate the role of creativity in science and are able to distinguish and characterize the two mental modes of scientific thought. They learn to distinguish the process of science from its communication, and acknowledge resulting biases in the literature.

Content:

Part I: Practical methodology

- Literature research and effective reading of the scientific literature
- Citing scientific publications
- Document structures of manuscripts and protocols
- Structured formatting of documents
- Effective graphics and tables
- Effective textual and graphical summaries
- The scientific publication process
- Presenting scientific results
 - Oral presentations at seminars and conferences
 - Scientific posters
 - Outreach to the public
- Good scientific practice
 - Avoiding plagiarism
 - Best practices in science

- Data management and reproducibility

Part II: The scientific method

- Falsification and the impossibility to prove a scientific hypothesis
- The role of auxiliary hypotheses and assumptions
- Paradigms and paradigm shifts in science
- The Iron Rule of science: solving all disputes by observation only
- The white lie of science: storytelling in scientific papers
- Distinguishing day science (data generation and hypothesis testing) and night science (generation of ideas to be tested)
- The different languages of day and night science
- Questions versus hypotheses
- The role of explorative data analysis
- Publication biases, p-hacking, and the reproducibility crisis

Conditions of Participation:

Enrolled in Quantitative Biology

Examination:

Project Work

Prerequisites for Awarding Credits for this Module:

Passing Project Work

Factor for the Overall Grade:

The grade is weighted according to the credit points (CP) in the overall grade.

Language:

English

Literature:

Further Information: -